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LET'S LOOK AT THE RECORD

By J. F. Kendrick, Head, Dairy Herd Improvement Section, Dairy Husbandry Research Branch, Agricultural Research Service, USDA. Presented in a panel discussion "Sire Evaluation", ADSA Annual Meeting, June 23, 1954.

To start our consideration of the subject of "Sire Evaluation" the committee planning this discussion asked that we first "look at the record" to see what results have been obtained in our artificial breeding program. My part on the panel is to focus our attention on possible use of some of the available pertinent data that we may have in our hands material which, together with similar material many of you have compiled in your own State, may be useful in the discussion that follows the panel's presentation of the subject.

Up to October 1, 1953, there were 3,281 sires used in artificial breeding studs that had daughters (artificial progeny) whose production records had been reported. These 3,281 sires had 77,044 daughters with 137,281 production records. The average production of the daughters was 10,564 pounds of milk and 413 pounds of fat. The following table shows the data grouped according to breed:

Table 1.- Average production of daughters (artificial progeny), by breed, of sires used in artificial breeding studs

Breed	Number sires	Number daughters	Number records	Average production (M.E. Basis)		
				Milk	Test	Fat
				Pounds	Percent	Pounds
Ayrshire	109	1,847	3,071	8,831	4.1	363
Guernsey	1,113	13,891	24,322	7,838	4.8	379
Holstein	1,288	53,188	96,553	11,754	3.6	426
Jersey	634	7,049	11,640	7,521	5.3	396
Brown Swiss	104	705	1,183	10,440	4.1	426
M. Shorthorn	23	56	87	8,397	3.9	326
Red Dane	10	308	425	8,725	4.1	356
Total or average	3,281	77,044	137,281	10,564	3.9	413

Measuring Results of AB Program

In an effort to obtain an indication of results of the artificial breeding program the production records of the AB daughters were averaged by year of freshening and compared with comparable yearly averages of all cows in DHIA's. This comparison is made in the following table.

Table 2.- Comparison of average production of daughters (artificial progeny) of AB sires with average production of all DHIA cows, by years

Year of fresh-ening	Number records	Average production of AB daughters (M.E. Basis)			Year of fresh-ening 1/	Average production of DHIA cows (M.E. Basis) 2/			AB daughters compared to DHIA cow average
		Milk	Test	Fat		Milk	Test	Fat	
		Pounds	Percent	Pounds		Pounds	Percent	Pounds	Pounds
1941	39	11,750	3.7	434	1942	9,155	4.1	373	+ 61
1942	165	11,179	3.8	420	1943	9,157	4.1	372	+ 48
1943	560	10,439	3.9	403	1944	9,125	4.1	370	+ 33
1944	1,362	10,412	3.8	399	1945	9,451	4.0	381	+ 18
1945	2,370	10,596	3.8	407	1946	9,498	4.0	384	+ 23
1946	4,551	10,552	3.8	400	1947	9,501	4.0	383	+ 17
1947	7,446	10,442	3.8	397	1948	9,542	4.0	385	+ 12
1948	12,447	10,747	3.8	409	1949	9,797	4.0	395	+ 14
1949	21,080	11,047	3.9	426	1950	10,089	4.0	407	+ 19
1950	30,650	10,807	3.9	420	1951	10,114	4.0	407	+ 13
1951	38,705	10,656	3.9	417	1952	10,111	4.0	403	+ 14

1/ Year lag - The major part of most lactation records with freshening dates in one year is made in DHIA testing years ending in the following year.

2/ M.E. average production is actual yearly average production plus 10 percent, i.e., in 1950 the yearly average butterfat production of all DHIA cows in the United States was 370 pounds, -- the M.E. is (370 + 37) 407 pounds. The M.E. yearly average production is more nearly comparable to the average M.E. 305-day lactation records than is the actual yearly average production.

The above data indicate that after 1944 when the number of AB daughters became significant they produced an average of from 12 to 23 pounds more butterfat than the average cow in dairy-herd-improvement associations.

It is recognized that the above comparison does not give a directly comparable measure of the progress made. While it may be the best over-all comparison we can make at present, further developments in our methods, growing perhaps out of this discussion today, may enable us to make more precise measurements in the future.

It would appear that one obvious improvement in the above method would be to compare the AB daughters of a particular breed with the average production for cows of that breed. Possibly further refinement would be to group the AB daughters of a breed by area or State and compare their production with the average of the breed in that area or State. Ultimately, a direct daughter-dam comparison of the AB sired daughters in the same herd with those sired in natural service would be desired.

Comparisons of Natural Proofs with AB Daughter Average

A problem of major concern in the AB program is the failure of bulls proved in one or two herds under natural service to produce daughters in AB service that average as high in production as the ones used in developing the daughter-average production in the natural proof. The real reason for this difference likely will be found in the differences in feeding and management in the herds where the daughters made their records.

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We examined the data included in the October 1, 1953, AB daughter list to see what could be learned regarding this problem. We assumed that 50 or more AB daughters would be a reliable indication of a bull's AB performance in the herds in which he was used.

In the tabulation of daughter records of AB sires made October 1, 1953, there were 289 Holstein sires with 50 or more AB daughters that also had "natural" proofs. To avoid possible breed differences, records of sires of only one breed were selected. The 289 sires averaged 139 AB daughters per sire and the average number of daughter-dam comparisons in the natural proofs was 17. In the following table the records of the sires were grouped according to their daughter averages in their natural proofs into various production level classes:

Table 3.--Comparison of average butterfat production of daughters in natural proof with that of daughters resulting from artificial breeding.

Production class interval for natural proof -lb. butterfat	Number sires	Daughter average natural proof - lb.	Average of all AB daughters lb.	Distribution of AB daughter averages of bulls according to production levels					
(1)	(2)	(3)	(4)	(5) Under 399	(6) 400 to 424	(7) 425 to 449	(8) 450 to 474	(9) 475 to 499	(10) 500 and over
				%	%	%	%	%	%
- 399	57	377	400	40	46	12	2		
+ 1/	(19)	(381)	(406)	(26)	(53)	(21)			
- 2/	(38)	(375)	(397)	(47)	(42)	(8)	(3)		
400 - 424	45	413	415	28	44	22	6		
+	(25)	(415)	(420)	(12)	(48)	(32)	(8)		
-	(20)	(411)	(409)	(45)	(40)	(10)	(5)		
425 - 449	61	437	425	11	33	51	5		
+	(49)	(438)	(425)	(8)	(37)	(49)	(6)		
-	(12)	(435)	(421)	(25)	(17)	(58)			
450 - 474	57	462	431	2	37	47	12	2	
+	(50)	(461)	(431)	(2)	(36)	(48)	(12)	(2)	
-	(7)	(464)	(429)		(43)	(43)	(4)		
475 - 499	28	485	435	11	18	46	21	4	
+	(25)	(485)	(433)	(12)	(20)	(48)	(16)	(4)	
-	(3)	(487	(451)			(33)	(67)		
500 +	(all +)41	525	448	2	15	37	22	20	4
Total	289	444	424	16	34	36	10	3	1

1/ Sires with daughter averages higher than dams.
2/ Sires with daughter averages lower than dams.

Of the 289 sires, 57 had natural proofs in which the daughters' average production falls in the class interval below 399 pounds butterfat. All of the daughters of these 57 sires averaged 377 pounds. The AB daughters of these same sires averaged 400. Forty percent of the 57 sires had AB daughters averaging 399 pounds of butterfat or less - 46 percent had AB daughters averaging between 400 and 424 pounds - 12 percent had AB daughters averaging between 425 and 449 pounds and 2 percent had AB daughters averaging between 450 and 474 pounds butterfat.

In the second class level (400 - 424) 45 sires had daughters in their natural proofs averaging 413 pounds of butterfat. The distribution of the sires, according to the average production of their daughters when used in AB studs, is indicated in the columns at the right of the table (Columns 5 to 10).

Glancing down through the table the data indicate that the higher the natural proofs the better the performance in AB studs (Columns 3 and 4). The data also indicate that some sires with relatively low natural proofs have a relatively high performance record in AB studs and that some sires with high natural proofs have a relatively low performance in AB studs.

Coming back to the first group of data, at the top of the table, 19 of the 57 sires in their natural proofs increased production, i.e., had plus proofs. Thirty-eight of the 57 sires had minus natural proofs. As indicated in the table at the low level natural proofs the "plus" sires tended to have a better performance record in AB studs than did the minus sires. A glance down the table shows, however, that at the high levels of natural proofs there was little difference in the performance of the minus or plus sires in AB studs.

Use of Herd Averages in Evaluating Sires

I believe we can assume that there is a high relation between the herd average production and the average production of the daughters used in the proof of a sire in the herds in which he is proved.

Of the 289 sires whose records were included in this study, we selected at random 57 for which we obtained data on the production average of the herds in which each AB daughter made her records. The individual dam and daughter comparisons were grouped into production class levels according to the average production of the herds in which they made their records and then averaged. The following table indicates the association between the herd average and the average production level of the daughters of the sires and their dams.

Table 4.- AB daughter-dam comparisons grouped according to average production of herd in which AB daughter made her record

Herd average: Production class interval	Herd average: Actual group average	Sires	Comparisons	Production: Milk	Production: Fat-
Pounds	Pounds	Number	Number	Pounds	Pounds
Up to 300	276	46	165 daughters	9,576	338
			165 dams	9,940	347
300 - 349	329	56	679 daughters	10,569	376
			679 dams	10,854	378
350 - 399	375	56	1,147 daughters	11,481	408
			1,147 dams	11,473	404
400 - 449	422	57	902 daughters	12,354	445
			902 dams	12,242	435
450 - 499	469	53	323 daughters	13,101	478
			323 dams	12,954	464
500 and up	526	32	89 daughters	14,471	540
			89 dams	13,142	472

Recognizing the association between herd averages and proofs, effort was made to devise a method of using herd averages as a base in evaluating sires.

A "norm" table was compiled to indicate the average level of production of daughters of proved sires in natural service in herds of various levels of production. This table was developed using 5,900 proved sire records compiled in 1952 and 1953. A composite herd average was compiled for the daughters of each sire. A three-year herd average for each herd represented in the proved sire record was compiled. When more than one herd was represented in the proved sire record the composite herd average was obtained by weighting the individual three-year herd averages according to the proportions of daughters represented in the proved sire record. The proved sire records were then grouped by breed and by herd average and summarized by herd average groups. The norms developed are shown in the following table:

Table 5.- Daughters' averages by breed of sires proved in natural service with various levels of production (Based on 5,900 proved sire records, 1952-3)

Production class interval of herd average 1/	Ayr-shire 2/	Brown Swiss 2/	Guernsey 2/	Jersey 2/	Holstein 2/	Short-horn 2/
Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Under 225						280
225 - 249						299
250 - 274						316
275 - 299	316	356	320	320	344	332
300 - 324	338	380	340	340	368	350
325 - 349	360	400	362	362	390	370
350 - 374	384	424	384	384	412	
375 - 399	408	446	408	408	436	
400 - 424	430	470	428	428	458	
425 - 449	454	485	450	450	480	
450 - 474		525	472	472	502	
475 - 499			487	487	524	
500 and over			524	524	546	

1/ Yearly herd average on a cow-year basis.
2/ Daughters' averages are based on M.E. records.

Referring to the column of norms for the Holsteins since we shall be using them in our next tabulation, the daughters of sires proved in herds averaging from 275 to 299 pounds of butterfat averaged 344 pounds of butterfat. The daughters of sires proved in herds averaging from 300 to 324 pounds of butterfat averaged 368 pounds of butterfat, etc.

On the theory that the norms for the various levels of herd averages might serve as a basis for indicating if the genetic worth of a sire was above or below average, the norms were used to separate the proved sire records used in the tabulation (Table 3) previously discussed. Herd averages could not be obtained on 9 of the 289 sires.

The following table shows the tabulation of the 280 proved sire records grouped by herd average of the herds in which the DHIA proof was made:

Table 6.- Comparison of AB performance of proved sires whose natural proved sire records were above or below their respective herd average norms

Production class interval of herd average group 1/	Herd average 1/	Sires	Average production of daughters used in "natural" DHIA proof 2/	Average production of daughters used in AB proof 2/	"Norm" of group 3/	Sires above or below "Norm": Sires above or below norm	Sires above or below "Norm": Average production of daughters used in "natural DHIA proof 2/	Sires above or below "Norm": Average production of daughters used in AB proof 2/	Difference
Pounds	Pounds	Number	Pounds	Pounds	Pounds	Number	Pounds	Pounds	Pounds
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
-350	326	43	407	412	390	27(above) 16(below)	427 373	423 395	+ 28
350-374	363	64	424	419	412	39(above) 25(below)	447 389	429 402	+ 27
375-399	386	77	441	426	436	46(above) 31(below)	467 402	434 414	+ 20
400-424	407	53	461	430	458	30(above) 23(below)	492 420	438 420	+ 18
425-449	435	28	487	430	480	15(above) 13(below)	515 455	438 421	+ 17
450+	477	15	509	441	502	8(above) 7(below)	549 463	450 430	+ 20

1/ Actual cow-year average.
2/ M.E. record.
3/ From data developed in Table 5.

In the tabulation (Column 3) 43 of the 280 sires were proved (natural proof) in herds with herd averages less than 350 pounds (Column 1). The actual herd average for the herds was 326 pounds (Column 2). The daughters' average in the natural proof of the sires was 407 pounds (Column 4). The AB daughters of these same sires averaged 412 pounds (Column 5). The norms for sires proved in herds with a herd average less than 350 pounds (Column 6) was 390. Of the 43 sires in the group, 27 (Column 7) of the sires according to their natural proofs were shown the norm and 16 were below the norm. Column 8 shows the daughter average of the natural proof of each group of sires and Column 9 shows the AB daughter average of each group of sires.

A glance down through the table indicates that sires above the norm in any herd level group tend to have similar performances in AB studs as shown in Column 9. Also, data in Column 10 suggests that choosing the sires that have daughters that average better than the norm or averages on the basis of natural proofs are likely to produce daughters in AB that produce better than those from sires that produce less than the average. The difference could be expected to be from 17-28 pounds butterfat. If the norm appears to be a promising tool in the evaluation of sires further study and refinement may make it a more accurate and precise tool.

Herd Averages

Herd averages on a cow-year basis are quite variable from year to year according to management practices and perhaps do not accurately represent the genetic producing capacity of a herd. Perhaps an average of all 305-day records completed in a herd in a year might be a more precise and stable figure as a herd average for use in sire evaluation than the calendar-year herd average.

We have some meager data on this point -- we hope there is more in the States and that it will be mentioned this afternoon during this discussion. From nearby Maryland DHIA's we obtained yearly herd averages for 5 herds covering a period of 6 to 8 years. The number of 305-day records completed during a testing year varied from 8 to 45 -- the average being 33. We obtained an average of the 305-day M.E. records completed in each testing year. The data are as follows:

Table 7.- Comparison of calendar-year butterfat herd (M.E.) averages with the average (M.E.) butterfat of 305-day records completed during the corresponding testing year

Testing year	Herd No. 1		Herd No. 2		Herd No. 3		Herd No. 4		Herd No. 5	
	Herd av.	Lactation av.	Herd av.	Lactation av.	Herd av.	Lactation av.	Herd av.	Lactation av.	Herd av.	Lactation av.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1946							377	428		
1947			515	497			457	434	453	517
1948	431	448	517	546	468	447	358	364	441	471
1949	460	469	538	581	446	443	315	382	419	491
1950	493	517	528	506	458	497	400	359	459	549
1951	512	517	515	484	502	487	375	358	494	544
1952	484	495	459	446	480	454	341	366	484	518
1953	499	511			441	449	384	382	494	495
Mean square	874	816	758	2,259	517	533	1,782	924	817	811

This very limited data and the results of the simple mean square test indicate that the cow-year herd average is at least as stable a figure to work with as the average of 305-day M.E. records.

On the following pages are tabulations of data pertinent to the subject we are discussing. These tabulations were compiled by the States indicated. In the general discussion following the panel's presentation we shall have an opportunity to have each State represented discuss the tabulations.

MASSACHUSETTS

Summary of M.S.B.A. Bulls Through March 31, 1954
Proofs on M.S.B.A. Daughters Only

All Jerseys

253 Daughters	(378) ave.	7862# M.	5.21 %	410# F.
133 "	(205) "	7800	5.17	403
133 Dams	(383) "	7541	5.07	382
Difference (72-75-76)		+259	+.10	+21

All Brown Swiss

36 Daughters	(45) ave.	11,391# M.	4.28 %	488# F.
23 "	(30) "	10,958	4.31	472
23 Dams	(83) "	10,879	4.15	452
Difference (12-18-12)		+79	+.16	+20

All Ayrshires

230 Daughters	(294) ave.	8,543# M.	4.20 %	358# F.
130 "	(169) "	8,585	4.20	361
130 Dams	(380) "	8,733	4.12	360
Difference (68-80-66)		-148	+.08	+1

All Guernseys

544 Daughters	(767) Ave.	7,951# M.	4.78 %	380# F.
357 "	(518) "	7,910	4.77	378
357 Dams	(1,093) "	8,075	4.73	382
Difference (157-191-170)		-165	+.04	-4

All Holsteins

1,304 Daughters	(1,908) ave.	11,506	3.66	421
809 "	(1,226) "	11,531	3.67	423
809 Dams	(2,583) "	11,370	3.62	412
Difference (430-448-456)		+161	+.05	+11

All Breeds

2,367 Daughters	(3,392) ave.	10,010	4.05	405
1,452 "	(2,148) "	10,026	4.04	405
1,452 Dams	(4,522) "			
Difference (739-812-780)		+60	+.05	+7

NEW YORK

Performance of AB Progeny in 303 DHIA Herds
(5 or more comparisons per herd)
(2x milking, 305 day, M.E.)

DHIA Herd	Number of Herds in Group	1949-51 Actual DHIA Group Av.	No. Animals	Milk	Test	Fat
Lb. fat		lb. fat		lb.	%	lb.
Up to 300	10	287	151 daughters	9041	3.6	324
			98 daughters	9165	3.6	334
			98 dams	9186	3.6	327
			Difference	-21	.0	+7
300 to 349	38	331	501 daughters	10075	3.7	368
			295 daughters	10224	3.7	374
			295 dams	10111	3.6	362
			Difference	+113	+.1	+12
350 to 399	123	376	1763 daughters	11164	3.7	411
			1243 daughters	11313	3.7	417
			1243 dams	11169	3.6	401
			Difference	+144	+.1	+16
400 to 449	99	422	1360 daughters	12855	3.5	453
			970 duaghters	12442	3.7	458
			970 dams	12149	3.6	438
			Difference	+293	+.1	+20
450 and UP	33	474	470 daughters	13700	3.7	504
			361 daughters	13849	3.7	510
			361 dams	13134	3.6	476
			Difference	+715	+.1	+34

NEW YORK

Comparison of Bull Proofs of Proved Sires Purchased for Artificial Insemination

	Natural Service Proofs						Artificial Insemination Proofs							
	Proof When Purchased			Last Proof			1st Year		2nd Year		3rd Year		4th Year	
	Pairs	Fat	Diff.	Pairs	Fat	Diff	Fat	Diff.	Fat	Diff.	Fat	Diff.	Fat	Diff.
Lady Boy	11	453	+ 53	41	459	+ 25	483	+ 39	479	+ 31	466	+ 22	437	+ 5
Inka	10	452	+ 65	21	441	+ 34	443	+ 6	434	+ 30	429	+ 26	425	+ 16
Resolute	5	449	+ 33	33	455	+ 5	531	+111	461	+ 54	429	+ 22	387	- 27
Hurlwood	5	495	+ 79	15	451	+ 31	383	+ 24	436	+ 42	412	+ 14	422	+ 19
Paul	14	505	+ 86	33	473	+ 16	502	+ 95	488	+ 6	430	- 4	442	- 13
Ocapok	10	435	+ 39	38	429	+ 38	492	+ 22	507	+ 40	487	+ 47	475	+ 35
Prince	9	486	+ 35	31	465	+ 6	455	+ 41	435	+ 59	414	+ 39	419	+ 31
Man-o-War	6	370	+ 71	15	372	- 6	355	- 46	359	- 51	375	- 31	389	- 25
Educator	7	480	+ 50	26	456	+ 29	465	+ 21			436	+ 15	434	+ 17
Norman	9	460	+ 38	14	409	- 6	395	- 25	398	- 11	409	- 1	403	- 9
Emperor	10	410	+ 81	13	393	+ 46	430	+ 53	456	+ 39	458	+ 57	461	+ 58
Beauty	7	488	+ 2	21	501	+ 33	437	+ 12	410	+ 19	452	+ 34	452	+ 25
Regina	5	456	+ 55	15	431	+ 47	379	+ 45	397	- 1	411	+ 17	411	+ 18
Rag Apple	10	547	+ 46	19	458	- 7	445	0	446	+ 23	446	+ 27	440	+ 19
Peerless	5	495	+ 43	14	455	- 8	453	+ 13	445	+ 22	438	+ 16	425	+ 24
Dean	25	472	+ 43	39	482	+ 38	475	+ 15	501	+ 82	486	+ 65	474	+ 57
Pride	25	438	+ 94	36	420	+ 67	479	+ 60	485	+ 56	476	+ 46	473	+ 47
Imp	18	522	+ 66	32	487	+ 35	442	+ 15	473	+ 65	462	+ 45	455	+ 39
Leo	6	425	+ 21	19	421	+ 20	395	- 27	400	- 37	401	- 33	391	- 35
Wimpy	19	419	+ 50	28	420	+ 42	467	+ 13	467	+ 48	456	+ 42	446	+ 56
Gypsie	15	460	+ 32	27	429	- 18	424	+ 3	419	+ 4	414	+ 3	426	- 5
Posch	8	520	+115	29	501	+ 83	484	+ 28	436	- 11	431	- 19	429	- 10
Richard	7	477	+ 52	9	410	+ 10	467	+ 13	420	- 2	416	- 3	417	- 8
Blend	14	504	+ 30	23	458	- 25	435	+ 17	415	- 2	412	+ 14		
Olena	10	492	+116	15	470	+ 63	441	+ 50	453	+ 30	437	+ 33		
Lunde	8	386	+ 34	16	378	+ 16	431	+ 16	406	- 14				
Marker	5	532	+ 8	41	453	+ 8	403	- 14	425	+ 13				
Jerome	11	438	+ 39	21	448	+ 6	431	+ 17	445	+ 17				
Seeley	7	457	+ 56	15	437	+ 24	468	+ 5	467	+ 57				
Al	6	509	+ 62	20	481	+ 48	444	+ 22						
Ambassador	17	469	+ 8	37	435	0	476	+ 42						
Canary	10	479	+ 48	19	470	+ 17	427	+ 15						
Jim	19	466	+ 27	29	458	0	401	- 41	391	- 29				
Masterp.	3	495	+ 92	10	535	+112	464	+ 19						
Pietertje	7	415	+ 78	7	415	+ 78	386	- 45	387	- 39				
Pilot	7	444	+ 29	10	425	+ 25	414	- 3						
Senator	22	433	+ 6	45	447	+ 13	428	+ 19	420	+ 21				
Sensation	11	490	+132	46	428	+ 34	431	+ 6						
Spice	16	423	+ 27	25	419	+ 33	445	+ 53						
Spitfire	16	480	- 18	22	457	- 1	391	+ 25						
Toby	10	536	+189	42	449	+ 68	357	- 48						
	445	466		1011	448		436		436		436		435	
No. Bulls		41			41		41		31		25		23	
No. Pairs		445			1011		715		1557		2075		2385	